A critical appraisal of “Virtual Reality Reflection Therapy Improves Balance and Gait in Patients with Chronic Stroke: Randomized Controlled Trials...”

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Abstract

For patients who suffer with stroke, it can develop muscle weakness and imbalances that can lead to mobility disorders, especially those of the lower limbs. Patients suffering from traumatic stroke conditions experience movement deficits that can impede on their quality of life. Quality treatments are continuing to be manufactured for such conditions in which one current intervention being researched is virtual reality reflection therapy (VRRT). This therapy method uses virtual reality technology to theoretically improve motor performance and balance and gait function in those who suffer from stroke.

This critical appraisal paper aims to assess the validity of the research study presented. This critical appraisal will progress through an introduction, methods, results, and discussion sections assessing the credibility of the article, validity of the intervention used and provide a conclusion as to whether the intervention can be used in a clinical setting.

The introduction will introduce the ideas behind the study which mentions the researchers' purpose and motivation for experimenting with VRRT on stroke patients. The methods section of this term paper will discuss the literature search process including databases and keywords used as well as justifications for choosing this research article. The methods section will also introduce background information about this research article including the authors, their affiliation, journal source and where the study was conducted.

The results section of this appraisal paper will provide a summary of the study as well as an appraisal of the introduction, methods, results, and discussion sections of the research article. The discussion section of this appraisal paper will provide a discussion as to whether the evidence and results of this research can be trusted and implemented in the future. This will

include the assessment of clinical applications as well as future research ideas for the intervention.

Lastly, this term paper will conclude in whether confidence can be expressed in this research and if it should or should not be implemented for future treatment of patients suffering from chronic stroke.

Key words: Virtual Reality Reflection Therapy, stroke, mirror therapy, balance, gait, physical therapy

Introduction

Virtual Reality Reflection Therapy (VRRT) is based on the mirror therapy concept. Taesung et al. states that mirror therapy uses visual illusion, where patients perceive the reflected image of their unaffected limb as the affected one. Taesung et al. explains that the mirror therapy concept is effective because motor neurons involved in learning new skills are activated through visual feedback although the patient's natural proprioceptive and sensory feedback are compromised because of stroke. There have not been any extensive studies done on this method of intervention, but Taesung et al. references recent studies that have resulted in improved upper extremity function. Thus, the purpose of the study presented was to apply the mirror therapy concept in VRRT, specifically for lower limb function of patients with stroke. The findings of this study are important because it can lead to scientific breakthroughs revolving around the treatment of paralysis, muscle weakness and mobility disorders of the lower limbs in stroke patients. Therefore, this critical appraisal will assess the validity of the evidence provided in the study to ensure that the results found are credible and can be applied for future interventions and

treatment of stroke patients. As well as finding an answer to the clinical question: how effective is virtual reality reflection therapy for the treatment of patients with traumatic brain conditions such as a stroke?

Methods

The databases used for the literature research include the PubMed database and Cochrane library. The keywords used to initiate the literature research were as follows: virtual reality, virtual reality therapy, virtual reality balance training, virtual reality stroke rehabilitation, and virtual reality treatment methods. The limitations put on the research results were free full text, articles from 2010 to present, and randomized-controlled trials. Free full text was a limitation added to receive full text on the articles chosen. Another limitation added was article results from 2010 to present. This way, research results were more current on the treatment methods that they are using. The last limitation used was randomized-controlled trials. This way I wouldn't be getting systematic reviews or review articles in my results. Inclusion criteria for the study included stroke, paralysis, and muscle weakness in the lower limbs. Patients with these conditions will have mobility disorders and will restrict their functional activities of daily living. These patients qualify for clinical trials experimenting with virtual reality therapy. Exclusion criteria for the study included apraxia, hemispatial neglect, orthopedic conditions, digital neuropathy, motor disability not due to stroke, and severe cognitive deficits. Patients that were physically unable to participate in virtual reality activities such as holding objects in hands, not able to sit or stand for longer periods of time or have cognitive deficits were excluded from these research trials.

This study to be appraised was done by Taesung In, Kyeongjin Lee and Changho Song. The study was performed in Seoul, Republic of Korea at the Sahmyook University, College of Health Sciences, Department of Physical Therapy. The research article was published in the *Medical Science Monitor: international medical journal of experimental and clinical research* on October 28, 2016. This research article clearly defines the need for further research into VRRT and presents an engaging hypothesis on lower limb mobility therapy for stroke patients.

Results

Summary of the study

This research article revolves around using virtual reality reflection therapy (VRRT) as a PT intervention for patients who have suffered from chronic stroke. The article states that virtual reality therapy is based off the concept of mirror therapy. It explains that mirror therapy "uses visual illusion, where patients perceive the reflected image of their unaffected limb as the affected one." Thus, having the patients use visual feedback to train the affected limb and improve overall function. The control group underwent a conventional rehabilitation program consisting of neurodevelopment training, physical therapy, etc. and a placebo VRRT program. While the experimental group additionally received VRRT program with their conventional rehabilitation program. The duration of these program for each group spanned five days a week for four weeks. The article states that changes in dynamic balance, static balance and gait ability were assessed before and after the intervention. Results showed that both groups displayed significant improvements after the intervention with the VRRT group showing further improvement than the control group. The study concluded that the effects of VRRT are beneficial toward patients with chronic stroke and experience deficits in balance and gait ability.

This study is significant in a clinical setting because the need for rehabilitation methods using inexpensive equipment has become apparent. VRRT presents a relatively cost-effective method for treating chronic stroke patients. It also consists of an independent training program which is less labor intensive for the therapists. This study can help the patients in the PT clinics by introducing a new concept into treating chronic stroke and partially restoring functionality in affected limbs. The concept of VRRT introduces elements such as functional specificity, balance training and performance of complex tasks that will help the patient feel more engaged through their rehabilitation. This study confirms that VRRT treatment is clinically relevant but needs to be experimented with further to increase specificity for how beneficial it can be for acute and subacute stroke patients.

Appraisal of the study introduction

The introduction gives background information as to the purpose of the study as well as thoroughly explaining the mirror concept theory. It explains the mechanisms and benefits behind their methods effectively. The introduction mentions reasons for the study such as the development of inexpensive equipment and to reduce the labor intense one on one treatments for the therapist. The introduction is well written explaining the clinical significance of the study as well as introducing the purpose clearly.

Appraisal of the study methods

The methods were written in a clear and organized manner simply explaining how the study was performed. The experiment performed was a randomized-controlled study in which it also stated that the assessors were blinded. The experimental group performing VRRT and a

conventional rehab program. While the control group underwent conventional stroke rehabilitation treatment plus a placebo VRRT. The study used tests such as the Berg Balance Scale (BBS), the Functional Reaching Test (FRT), and the Timed Up and Go (TUG) test to assess both groups. This study is a longitudinal study because it treats the subjects through thirty minutes a day for five days a week for four weeks and has follow up interviews later. This is a between-subjects study because they are comparing the treatments and outcomes of the two groups. The study also included reasonable inclusion and exclusion criteria which ensures quality participants that can potentially yield the best results.

Appraisal of the study results

The results were clear as it explained how they achieved their results along with the statistical analysis. The study did address the research question in their results. They explained the data they received from their study and used it in answering whether virtual reality therapy or conventional physical therapy was more effective in stroke rehabilitation. The study used multiple tests to receive their data and presented their outcome measures in a clear and precise manner. They used this data to compare the experimental and control group and evaluate their hypothesis. The study provides a lengthy but professional table of their statistical analysis that displays their numerical results from the tests performed. The statistical analysis presented seems very descriptive, however, they did not mention a clinical significance to their values achieved.

Appraisal of the study discussion

The study effectively explains the meaning behind the data collected. It describes the importance of the data and how they concluded their results from it. The authors compared their

study with other studies and compared their data and results. They also listed their limitations and what they would like to see done with future research. Limitations such as not using magnetic resonance imaging in their study and not involving patients at the acute or subacute stroke stages. They explained that this study can be used to display modes of the lower extremity as safe training options with patients that have stroke conditions. The study concluded that VRRT rehabilitation training was beneficial on balance and gait ability in patients with chronic stroke, but further research needed to be done on the acute and subacute stages.

Discussion

This study is clinically relevant because it provides a more cost-effective option for stroke rehabilitation as well as providing a less intensive experience for the therapist in a one-on-one session. The study provides potential answers to the clinical question of if VRRT can be effective in treating patients that experience or have experienced stroke.

The intervention used in this study can be effective in treating stroke as it supports their reasoning with credible statistical data displaying that VRRT can improve balance and gait in patients with stroke. One potential risk of using this intervention in a clinical setting is increased fall risk from using multiple balance assessments combined with potential disorientation of the patient from the virtual reality training. Further research needs to be performed on patients in the acute or subacute stages of stroke for this intervention to be used on a wider variety of patients.

I am confident in the evidence provided in this research and I would feel confident showing and explaining it to a future patient. I feel this way because the research was credible in its references and provided compelling statistical data to support their findings. As well as

providing a descriptive explanation as to their reasoning behind their methods and execution of their procedures. If given the knowledge, resources, and skills to implement this intervention in a future setting I would feel comfortable knowing that it would be safe and would yield the desired results for my patients.

In conclusion, the findings of the research presented was impressive and further research needs to be done into the acute and subacute stages of stroke to cement it as a reliable intervention option for patients with stroke. As for chronic stroke patients, I feel confident that this intervention can consistently yield the results as was displayed in the research.